The ERM-Mux/plus is a 4U 19(23)” 14 slot rack type E1 Time Division Multiplexer for Fractional E1 network access which is designed for non-stop operation. There are 10 slots available for hot-swappable ERM-Mux/plus-I/O cards. Two slots are provided for Mux-E1 cards, which may be configured as four separate E1 links or for redundant 1+1 operation of the E1 lines, safe guarding against expensive network down time. Two slots are also available for CPU cards, with the second CPU card acting as a hot standby in case of primary card failure. Each Mux-E1 card may be linked to another ERM-Mux/plus Rack to provide a point-to-point variety of datacom, Ethernet & voice over E1 network services. The ERM-Mux/plus optionally accommodates up to two separate power supplies, which may derive power from AC (110/220) or DC (-48V) power sources. When two power supplies are installed, the modules provide complete power redundancy and are hot swappable even during the E1 cards’ transmission. The ERM-Mux/plus provides all interface connections on the front panel, BNC and RJ-45 are used for E1 Line interface connections, RJ-45 connections are used for all voice (FXO, FXS, E&M), for 10/100 Ethernet Bridge and G.703-64K co-directional / contra-directional / center. Optional cable adapters are used to convert the DB-62F DCE ports of the I/O cards to 6xRS-232, HP68F DCE port of I/O card to 4x V.35, RS-232, RS-530, RS-449, RS-422 and X.21 or 5x X.50 channels.
Features
- CPU redundancy (1+1)
- E1 redundancy (1+1) and E1 card redundancy
- Power redundancy (1+1) [2AC, 2DC, AC-DC]
- DC E hot swap card types
  - 4ch V.35 (nx64k)
  - 4ch G.703 64k co-directional / contra-directional / centerted mode
  - 2ch Ethernet bridge
  - 6ch RS232
  - 6ch FXS voice
  - 6ch FXO voice
  - 6ch E&M voice
- Drop & Insert function
- Console, NMP, SNMP, management

Connectors
- Console port (RJ45, RS232C)
- WAN port RJ45 Jack (2-wire, 4-wire).

Physical Specifications
- Dimensions: 350 x 438 x 176mm (W x D x H)
- Weight: 8kg (chassis+ dual power+ 8 I/O cards) 450g per card

Power Characteristics
- AC : AC 90 ~ 250VAC
- DC : DC -48VDC

Environmental Specifications
- Operating: 0°C to 60°C
- Storage: 0°C to 70°C
- Relative humidity: 0% to 90% non-condensing
- Predicted MTBF: 65,000 hrs (25°C)

Certification
- CE

Features
- CPU redundancy (1+1)
- E1 redundancy (1+1) and E1 card redundancy
- Power redundancy (1+1) [2AC, 2DC, AC-DC]
- DC E hot swap card types
  - 4ch V.35 (nx64k)
  - 4ch G.703 64k co-directional / contra-directional / center mode
  - 2ch Ethernet bridge
  - 6ch RS232
  - 6ch FXS voice
  - 6ch FXO voice
  - 6ch E&M voice
- Drop & Insert function
- Console, NMP, SNMP, management

1+1 Redundant
The ERM-MUX/PLUS supports complete redundant functions for the electrical input service, the power module cards, CPU card and E1 card. The E1 backup provides 1+1 modes. All of these cards are capable of automatic switchover in case of failure. The system has complete warning and diagnostic functions for stable and reliable operation.

Network Management
The ERM-MUX/PLUS supports SNMP (Under development) and/or NMP GUI network management with local PC or via a dedicated timeslot from the E1 line. The NMP GUI can manage more ERM-MUX/PLUS equipment via the E1 network in-line or in nested structures. A console terminal mode is supported as well. When SNMP management mode is available and selected, remote Telnet and HTTP embedded web server are also available for management.

Cascade
RS-485 interface is used for cascading expansion rack, and are provided by RJ-45 x 2 connectors. DB62 connector for connecting backplane data to expansion rack.

Power Redundancy
Power supply options for 110V AC, 220V AC or -48V DC, ensure maximum flexibility for central office installations. This equipment complies fully with all ITU-T standards for E1 transmissions. The modules are hot-swappable, capable of automatic switch over in case of module failure, stable, and reliable.

Performance and BERT test
System supports performance monitoring and BERT test through NMP or Terminal console according RFC 1406 recommendation. CRC-4 and BPV monitoring: CURR ES / UAS, LONG ES / UAS. Loopback test and BERT test: display Rx error amounts, Error counts and Bit-error-rate. Test patterns: 2e9-1, 2e11-1 and 2e15-1. Error Insertions and rates: Single, 10e-1, 10e-2, 10e-3, 10e-4, 10e-5, 10e-6, 10e-7.

Ordering Information
ERM-Mux-Plus- [ ] [ ] [ ] Power type
  - AA-CH : chassis for AC+AC power
  - DD-CH : chassis for DC+DC power
  - AD-CH : chassis for AC+DC power
  - AC : 90~250VAC power card
  - ACV : 90~250VAC power card with voice support
  - DC : -36 to -72VDC
  - DCV : -36 to -72VDC with voice support

Example: ERM-Mux-Plus-AA-CH

ERM-Mux-Plus- [ ] [ ] [ ] Optional card
  - 2E1R : 2ch E1RJ45 card
  - 4E1R : 4ch E1RJ45 card
  - 8E1R : 8ch E1RJ45 card
  - 2E1B : 2ch E1BNC card
  - 4E1B : 4ch E1BNC card
  - 8E1B : 8ch E1BNC card
  - CPU : CPU card
  - SNMP : SNMP card
  - FXO : 6ch FXO card
  - FXS : 6ch FXS card
  - E&M : 6ch 2/4 wire E&M card
  - RS232 : 6ch RS232 card
  - G64K : 4ch G703 64k card
  - Data V35 : 4ch V35/X21/RS449/RS530 card
  - RS485 : 6ch RS485/422 card
  - ET1000 : 2ch 10/100Base-TX card

Example: ERM-Mux-Plus-2E1R
ERM-Mux/Plus

Connection with PBX (Program Controlled Exchanger)

Data connection among multiple points

The extension and expansion of DDN (Data Distribution Network)
The ERM-Mux/plus has two dedicated slots for installing E1 aggregate cards. Currently E1 cards are available with 2, 4 or 8 E1 ports. In the backplane design of the ERM-Mux/plus, a maximum of 4 E1s can carry data to and from tributary (I/O) cards. One typical application could be to install two 4E1 cards in the chassis and have the cards act as one master and one hot-standby card for E1 redundancy. For other applications, an 8E1 card could be used to cross connect E1 timlots prior to assignment to the four available backplane channels. Another application can use the 'extra' E1 aggregate channels for drop & insert (Sub-E1) rather than performing cross connection. It can quickly be seen that a large number of applications are possible with the ERM-Mux/plus's flexible design.

### Features
- Available in 2, 4 or 8 E1 channels
- Supports PCM31 or PCM30 framing
- Can provide path/card redundancy
- E1 timeslots can support cross-connection function
- E1 channel can act as Sub-E1 for Drop/Insert
- Hot Swappable

### Specifications
- **Frame format**: CAS(PCM31)/CCS(PCM30)
- **CRC on/off**: Ture
- **Bit rate**: 2.048Mbps
- **Line codes**: HDB3/AMI
- **Rx sensitivity**: 0 ~ -43dB
- **Tx driver**: 1.5km over 0.5mm E1 cable
- **Line impedance**: 75 ohms (unbalanced)
- **Pulse amplitude**: nominal 3.00V (120ohm)
- **Pulse shape**: According to ITU-T G.703
- **Temperature**: 0°C ~ 50°C
- **Humidity**: 5~95%
- **MTBF**: 65,000 hrs

---

**ERM-Mux/Plus Application**

**Data, Ethernet, Voice, E1 MUX Solution**

[Diagram of ERM-Mux/Plus Application]

---

**ERM-Mux/Plus-E1**

[www.ctcu.com]
**Fast Ethernet Bridge Tributary Card**
**ERM-Mux/Plus-ET100**

The ERM-Mux/plus Ethernet Bridge Tributary Card provides Ethernet over E1 capability. Incorporating two separate channels, this transparent bridge supports industry standard HDLC encapsulation. The WAN data rate depends on the number of E1 timeslots assigned (Nx64). The front panel has two RJ-45 shielded connectors for connection of 10Base-T or 100Base-TX Ethernet and status LEDs for each channel to display link state, speed, duplex and activity. Rounding out each bridge channel are support for 256 MAC filter address learning table and 340 packets buffer to aid in handling LAN side burst traffic.

**Features**
- Two independent Ethernet over E1 channels
- Utilizes HDLC WAN encapsulation
- MAC Address learning table with 5 minute aging
- Auto-MDIX and Auto-Negotiation
- Hot Swappable

**Specifications**
- Standards : IEEE 802.3, IEEE802.3u
- Throughput latency : 1 frame
- MDI / MDIX : Auto
- Filtering : 256 MAC address table
- Buffer : 340 packets
- Encapsulation : HDLC
- Throughput latency : 1 frame
- Temperature : 0°C ~ 50°C
- Humidity : 5~95% (non-condensing)
- MTBF : 65,000 hrs

**Nx64 Synchronous Serial Tributary Card**
**ERM-Mux/Plus-Data**

The ERM-Mux/plus Nx64 Serial Tributary Card provides V.35/ X.21/ RS-530/ RS-449 Synchronous data capability. Incorporating four separate channels, each channel can independently assign any Nx64 timeslots from the aggregate E1. The single HD68 connector mates to a 1 to 4 cable that terminates to the required connector type. Four different cables provide connection to V.35’s MB34, X.21’s DB15, RS-530’s DB25 or RS-449’s DB37 female connectors. Please be sure to select the right cable for your application when ordering this card.

**Features**
- Four independent Synchronous channels
- Nx64 setting from any E1 channel
- Each channel operates in native DCE mode
- Diagnostic loop backs
- LED indicators for Power, Alarm, RD/TD activity
- Hot Swappable

**Specifications**
- ITU-T and ANSI compliant Datacom interfaces
- Multiplexing Nx64K data onto E1 time-slot.
- Data speed : Nx64K(N=1 to 30, or 31).  
- Data access : RS-530, RS-449, V.35, X.21, supplied with corresponding interface cable.
- Access mode : DCE
- Diagnostics : Local / Remote / Bi-directional Loop
- Temperature : 0°C ~ 50°C
- Humidity : 5~95%
- MTBF : 65,000 hrs
Asynchronous RS-485/442 Serial Tributary Card
ERM-Mux/Plus-RS485

The ERM-Mux/plus Asynchronous RS485/442 Serial Tributary Card provides six independent RS-485/RS-422 data channel capability. Incorporating six separate channels, each channel can independently assign any Nx64 timeslots from the aggregate E1. Each channel uses a pluggable 4-pin terminal block for connection one or two twisted pair wires. No cables are provided with this card. When connecting to RS-485, the channel supports 4-wire Full Duplex or 2-wire Half Duplex RS-485 transmissions for serial control or data acquisition.

### Features
- Six independent channels
- Nx64 setting from any E1 channel
- Transparent asynchronous rates up to 128kbps
- Diagnostic loop backs
- Hot Swappable

### Specifications
- **Interface**: RS422 4 wire, RS485 4/2 wire
- **LEDs**: RS485/422 TD/RD, Power, Alarm
- **Baud rate**: Async mode <= 128K
- **Bit Error Rate**: Less than $10^{-10}$
- **Connector**: 4pin Terminal Block x 6
- **Duplex**: Full / Half
- **Temperature**: 0°C ~ 50°C
- **Humidity**: 5~95%
- **MTFB**: 65,000 hrs

---

RS232 Sync/Asyn Tributary Card
ERM-Mux/Plus-RS232

The ERM-Mux/plus Sync/Async RS232 Serial Tributary Card provides six independent RS-232 data channel capability. Incorporating six separate channels, each channel can independently assign any Nx64 timeslots from the aggregate E1. The single DB62 connector mates to a 1 to 6 cable that terminates to DB25 female connectors. These serial data channels may be linked to leased line modems for further extension or connected to other data terminal or data acquisition devices. When configured for synchronous use, the data connectors carry both clock and data. For asynchronous use, the clock signals can be ignored.

### Features
- Six independent channels
- Nx64 setting from any E1 channel
- Transparent asynchronous rates up to 115.2kbps
- Synchronous 64 or 128Kbps, DCE mode
- Diagnostic loop backs
- LED indicators for Power, Alarm, RD/TD activity
- Hot Swappable

### Specifications
- **ITU-T V.24 compliant Datacom interfaces**
- **Multiplexing Nx64K data onto E1 time-slot.**
- **Data speed**: Nx64K(N=1 to 2).
- **Data access**: RS-232, supplied with corresponding interface cable.
- **Access mode**: DCE
- **Diagnostic**: Local/Remote /Bi-directional Loop
- **Temperature**: 0°C ~ 50°C
- **Humidity**: 5~95%
- **MTFB**: 65,000 hrs
**G.703 64K Co-directional Tributary Card**

**ERM-Mux/Plus-G64K**

The ERM-Mux/plus G64K Tributary Card provides six independent G.703 64Kbps Co-directional data channel capability. Each channel can independently assign any 64Kbps timeslot from the aggregate E1. Individual Shielded RJ-45 connectors that conform to USOC RJ-48C standard wiring provide the G.703 connections. Standard UTP or alternately shielded UTP are both acceptable cabling media. These data channels may be linked to multiplexers, terminal equipment or satellite/micro-wave transmission equipment. In Co-directional signaling, the clock signals are recovered from the received G.703 data stream. Only Tx and Rx pairs or a total of 4 wires are required in 64Kbps co-directional transmission.

**Features**

- Six independent channels
- 1x64 setting from any E1 channel
- Transparent synchronous rate of 64Kbps
- Co-directional clock recovered from Rx G.703
- Diagnostic loop backs
- LED indicators for Power, Alarm, Tx/Rx activity
- Hot Swappable

**Specifications**

- ITU-TG.703, G.823 64kbps compliant interfaces
- Multiplexing 1x64K data onto E1 timeslot.
- Data speed : 64Kbps +/-100ppm.
- Data access : RJ-45 per USOC RJ-48C standard
- Line code : Co-directional
- Pulse shape : according to G.703
- Transmit distance : 600M or less (0.5~0.7mm TP)
- Diagnostics : Local /Remote /Bi-directional Loop
- Temperature : 0°C ~ 50°C
- Humidity : 5~95%
- MTBF : 65,000 hrs

---

**E&M Voice Tributary Card**

**ERM-Mux/Plus-E&M**

The ERM-Mux/plus E&M Voice Tributary Card provides six independent Ear & Mouth Voice channel capability. Each channel can independently assign any 64Kbps timeslot from the aggregate E1. Individual Shielded RJ-45 connectors provide the voice connections. Standard UTP or alternately shielded UTP are both acceptable cabling media. These voice channels may be linked to PBX (Private Branch Exchange) to facilitate voice to voice connections. The channels support selection of Type 1~5, support 2 or 4 wire operation and have 0.5dB steps for signal attenuation.

When using this card, an appropriate voice compatible power module must be used in the ERM-MUX/Plus.

**Features**

- Six independent channels
- 2/4 wire independent setting
- 1x64 setting from any E1 channel
- E&M Signaling PBX trunks
- Provides E line, M line, SB (battery) and SG (ground) lines
- G.711 Codec
- LED indicators for Power, Alarm, activity
- Hot Swappable

**Specifications**

- Loop current : 5~30 mA, maximum 70 mA.
- Return loss : 300-600Hz >12dB (2W)
  600-3400Hz >15dB (2W)
  300-3400Hz >20dB (4W)
- Group delay : @-10dBm0 <750usec (2W) <600usec (4W)
- Total Distortion : according to ITU-T.G223
- Channel crosstalk : < -65dB, 1020Hz@0dBm0
- Noise : <65dBm0p weighted
- Temperature : 0°C ~ 50°C
- Humidity : 5~95%
- MTBF : 65,000 hrs
FXO Voice Tributary Card
ERM-Mux/Plus-FXO

The ERM-Mux/plus FXO Voice Tributary Card provides six independent Foreign Exchange Office Voice channel capability. Each channel can independently assign any 64Kbps timeslot from the aggregate E1. Individual Shielded RJ-45 connectors provide the voice connections. Standard UTP or alternately shielded UTP are both acceptable cabling media. These voice channels may be linked to PBX (Private Branch Exchange) or PSTN (Public Switched Telephone Network) to facilitate voice to voice connections. When using this card, an appropriate voice compatible power module must be used in the ERM-Mux/plus.

Features
- Six independent channels
- 2 wire
- G.711 Codec
- 1x64 setting from any E1 channel
- PCM30 R2 Signaling PSTN trunks
- Links PBX to PBX or extends POTs
- LED indicators for Power, Alarm, activity
- Hot Swappable

Specifications
- On-hook DC resistance : >100K Ohms
- Ring AC resistance : >7.5K Ohms
- Ring power sensitivity : <50mW
- Off-hook DC resistance : <300 Ohms
- Max. Input Voltage : 70VDC
- Max. Input Current : 150mA
- Return loss : 300-600Hz >12dB (2W)
- Channel crosstalk : < -65dB, 1020Hz@0dBm0
- Noise : <65dB, 1020Hz@0dBm0
- Temperature : 0°C ~ 50°C
- Humidity : 5~95%
- MTFB : 65,000 hrs

FXS Voice Tributary Card
ERM-Mux/Plus-FXS

The ERM-Mux/plus FXS Voice Tributary Card provides six independent Foreign Exchange Station Voice channel capability. These 6 channel tributary cards are designed for voice applications over E1. Typically, an FXS connects to a standard telephone set. The FXS needs to sense on-hook, off-hook or disconnected status. It also must be able to provide ring function to a telephone set and it must pass caller-ID information.

In the ERM-Mux/plus point-to-point application, the FXS can connect to a remote FXO (Foreign Exchange Office) when deployed as an extension from PBX (Private Branch Exchange) or PSTN (Public Switched Telephone Network). It may also connect to a remote FXS, also for extension from PBX or as a direct ‘hotline’ voice connection. Individual Shielded RJ-45 connectors provide the voice connections. When using this card, an appropriate voice compatible power module must be used in the ERM-Mux/plus.

Features
- Six independent channels
- 2 wire
- G.711 Codec
- 1x64 setting from any E1 channel
- Provides ring function
- Supports caller-ID forwarding
- PSTN extension or direct ‘Hot-line”
- Links PBX to PBX or extends POTs
- LED indicators for Power, Alarm, activity
- Hot Swappable

Specifications
- Effective ring voltage : AC 75VRMS +/-15V@25Hz +/-3Hz, <10% THD
- Loop resistance : <1.8K Ohms, including 300 Ohms for telephone
- On-hook current : 10mA +/-3mA.
- Off-hook loop current : 18-50mA.
- Surge protection : 1000V, 10uSec transient response, decay to 50% in 700uSec
- Channel crosstalk : < -65dB, 1020Hz@0dBm0
- Noise : <65dB, 1020Hz@0dBm0
- Temperature : 0°C ~ 50°C
- Humidity : 5~95%
- MTFB : 65,000 hrs